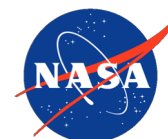
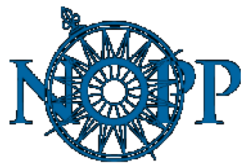


# AMBON: Arctic Marine Biodiversity Observing Network

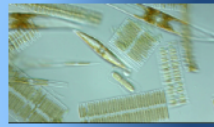
Iken K<sup>1</sup>, Cooper L<sup>2</sup>, Grebmeier J<sup>2</sup>, Danielson S<sup>1</sup>, Mueter F<sup>1</sup>, Hopcroft R<sup>1</sup>, Stafford K<sup>3</sup>, Kuletz K<sup>4</sup>, Collins E<sup>1</sup>, Kavanaugh M<sup>8</sup>, Bluhm B<sup>1,5</sup>, Moore S<sup>6</sup>, Buckelew S<sup>7</sup>, Bochenek R<sup>7</sup>

(1) University of Alaska Fairbanks; USA; (2) University of Maryland, USA; (3) University of Washington, USA; (4) US Fish and Wildlife Service, USA; (5) University of Tromsø, Norway; (6) National Oceanographic and Atmospheric Administration, USA; (7) Alaska Ocean Observing System/AXIOM, USA; (8) Oregon State University



# AMBON status

- What have we done in the past year, and how is that work addressing the needs of our targeted users?
- How are we measuring the impact on the user community that we serve?
- How are we progressing with shared cross-MBON priorities, advancing eDNA methods for the MBON community, and leveraging seascapes?



**What have we done in the past year, and how is that work addressing the needs of our targeted users?**

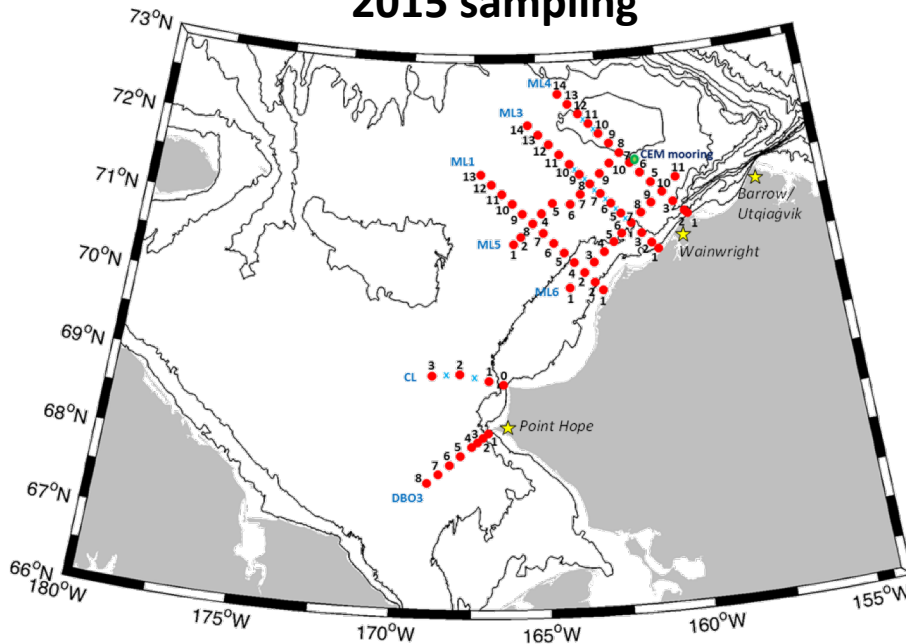


- **Field work**
- **Data publication**
- **Manuscripts**
- **Seascapes**

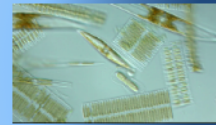
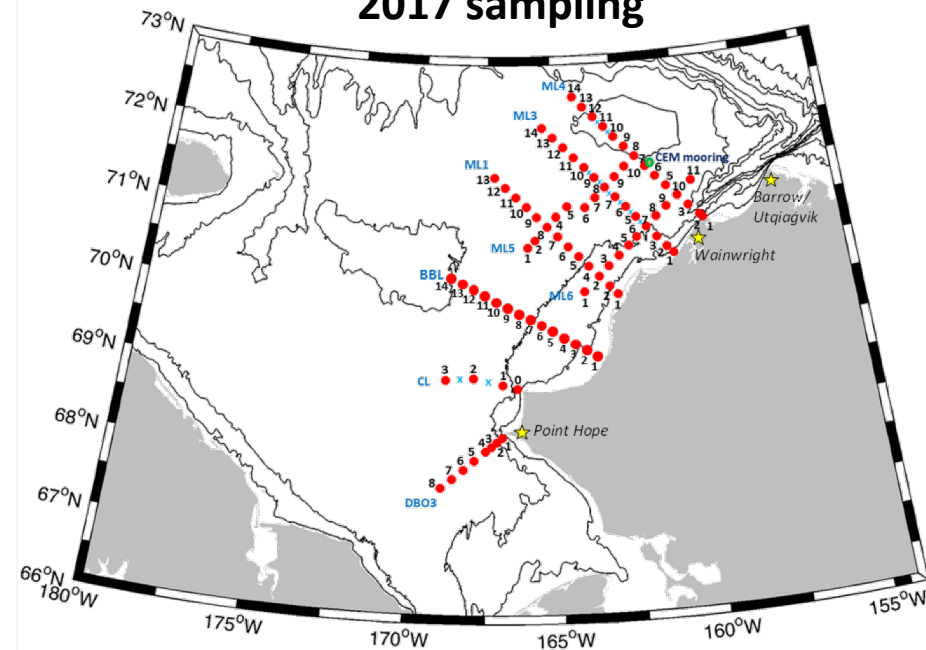
# AMBON field work

- interannual variability
- long-term data sets

2015 sampling

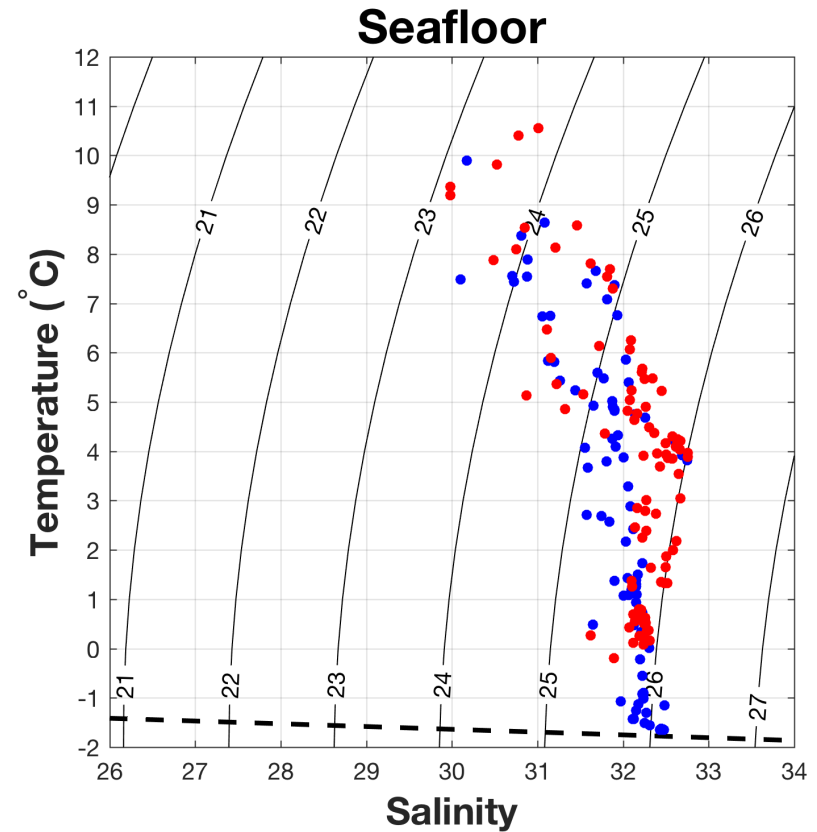
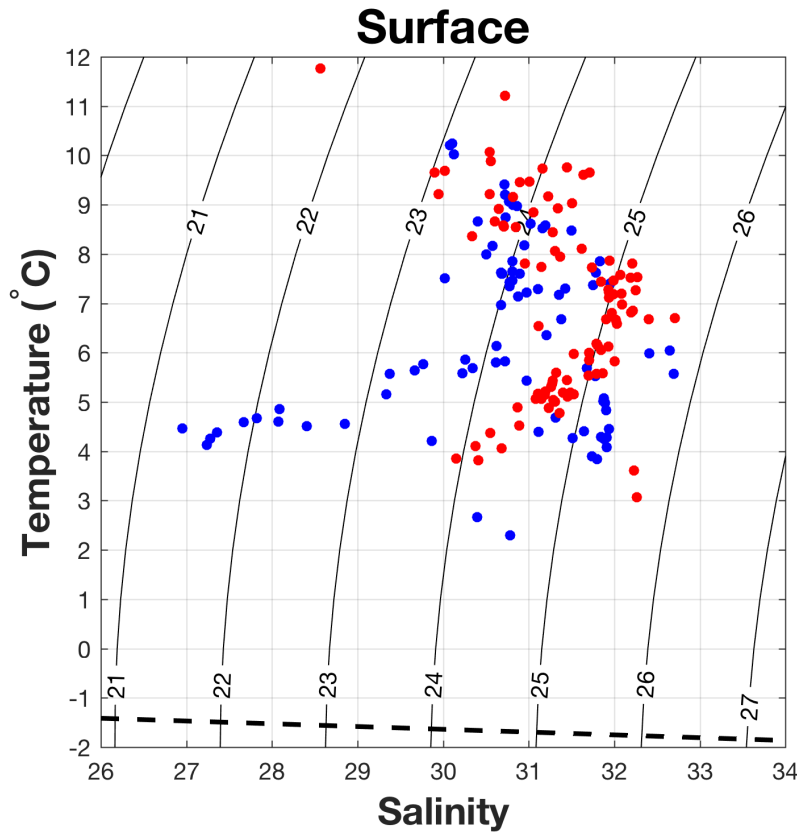


2017 sampling





- Environmental interannual variability



**2015: fresher, colder**

**2017: saltier, warmer**

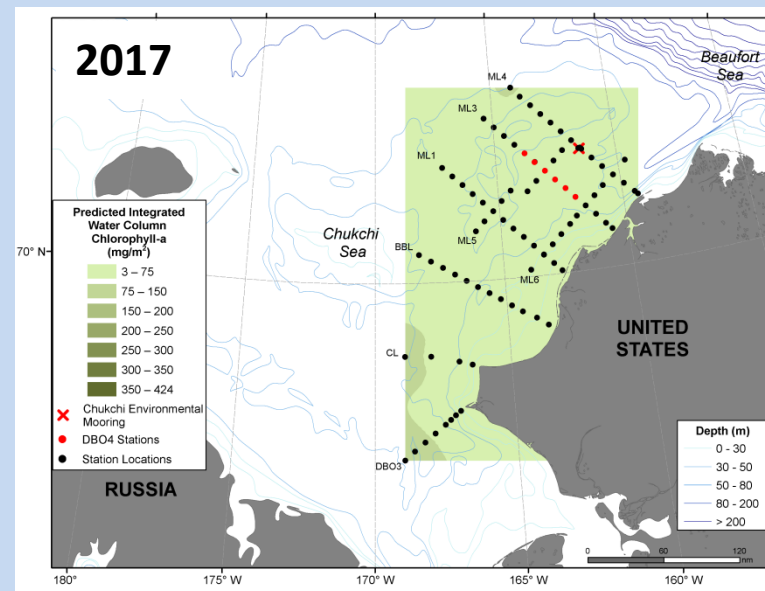
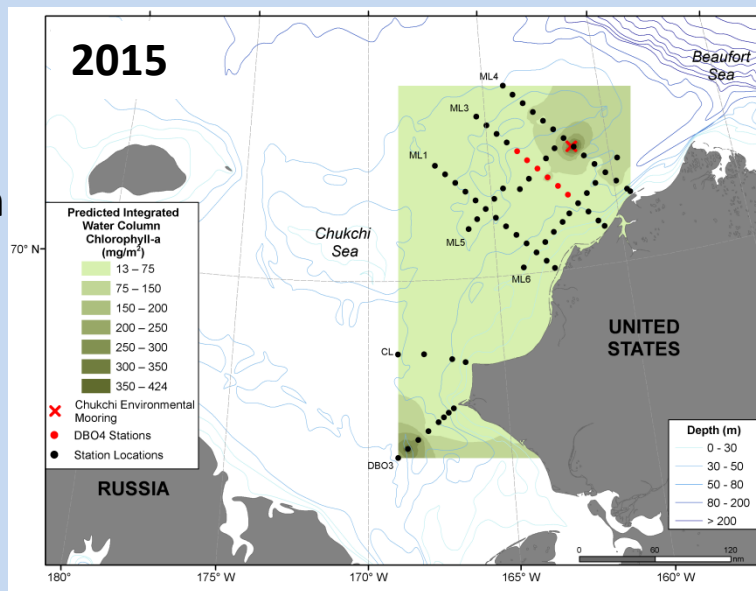
# Past year - field

## Impact

## X-MBON

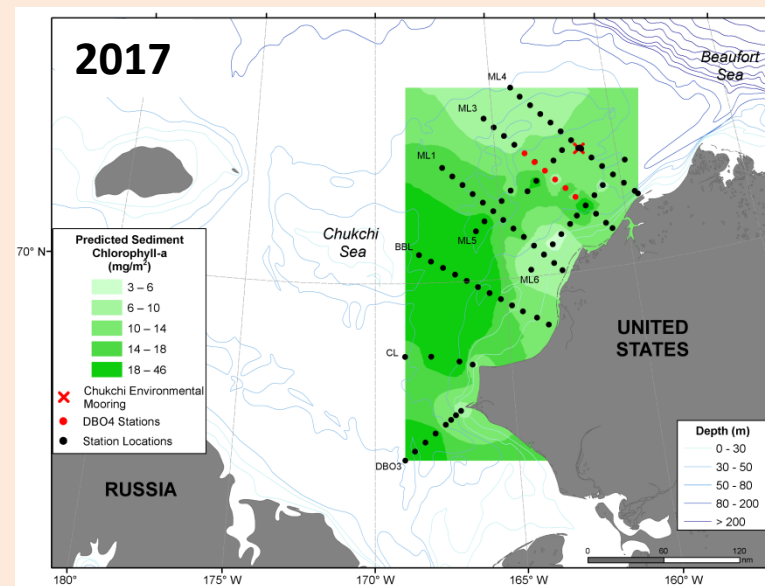
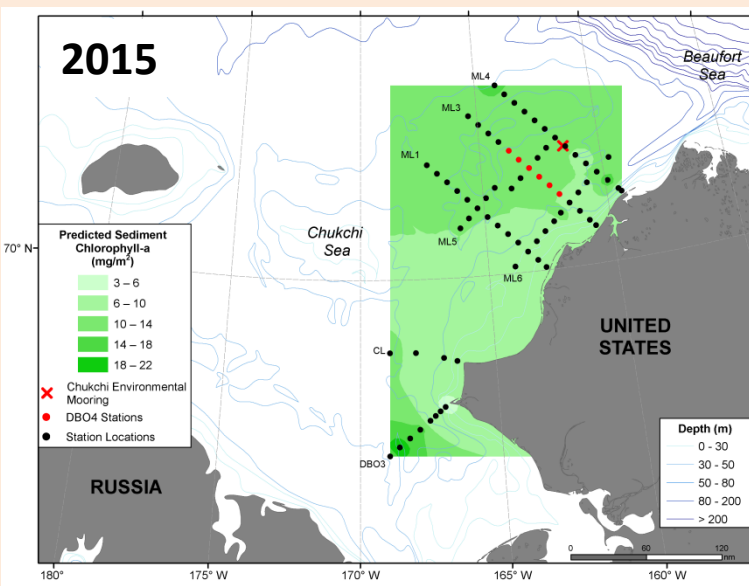
### Water column chlorophyll

Higher in 2015  
Bloom ongoing

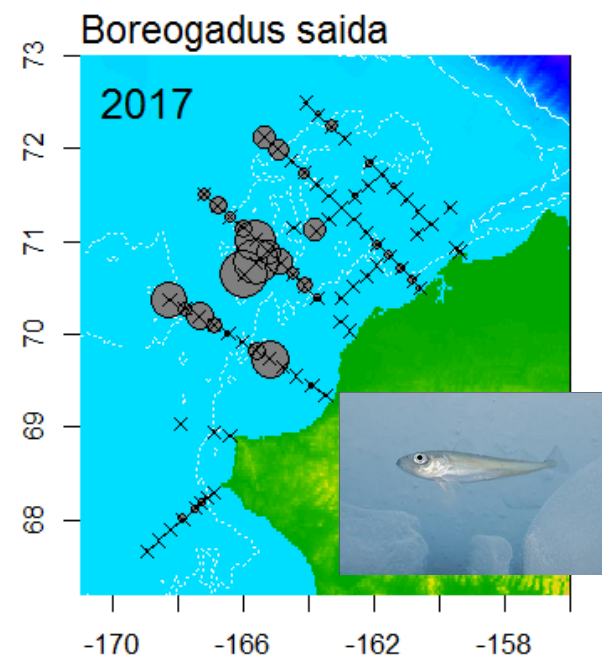
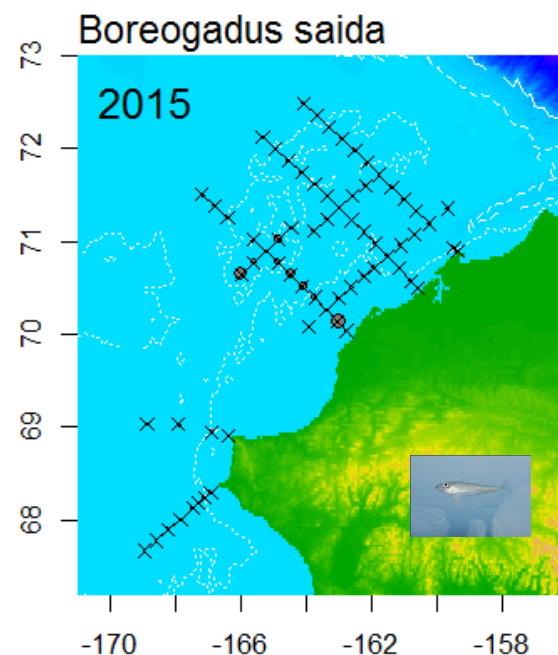
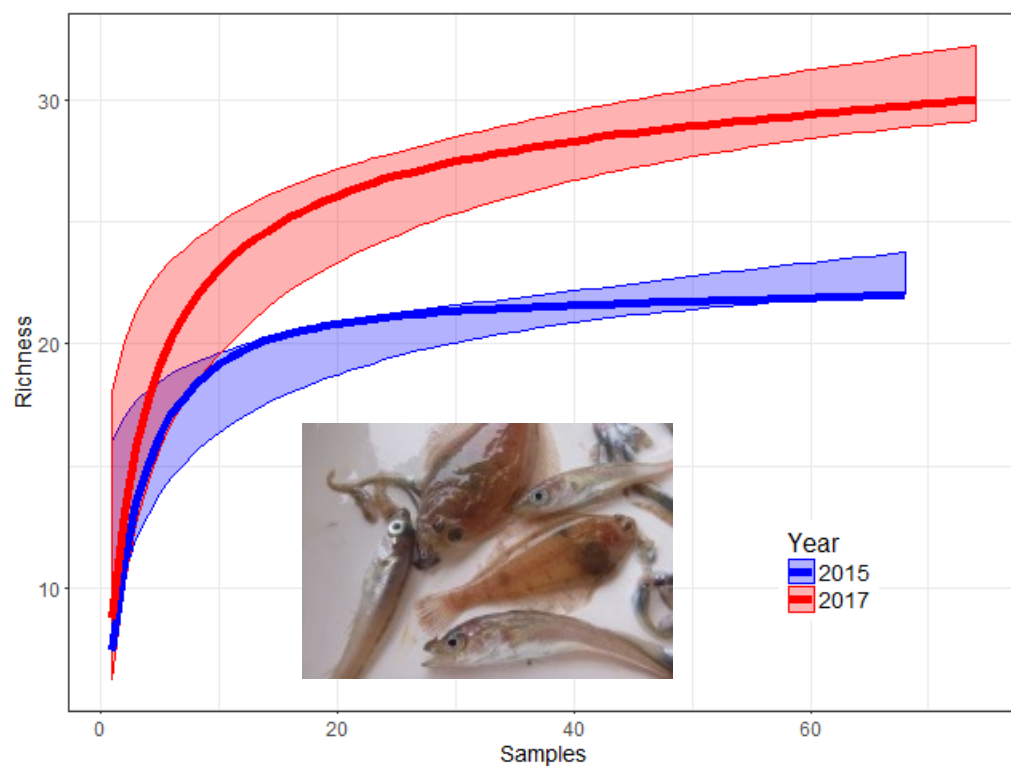


### Sediment chlorophyll

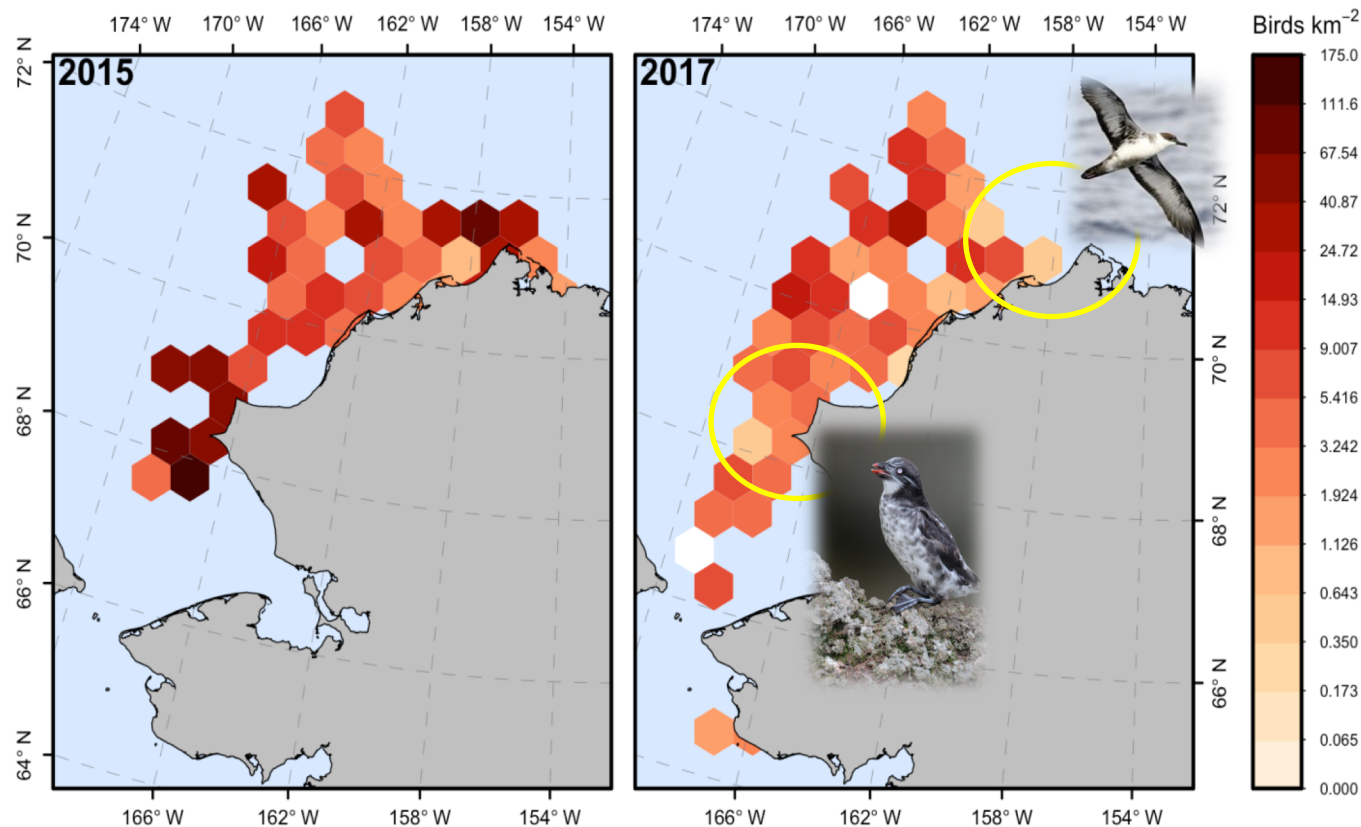
Higher in 2017  
Bloom settled

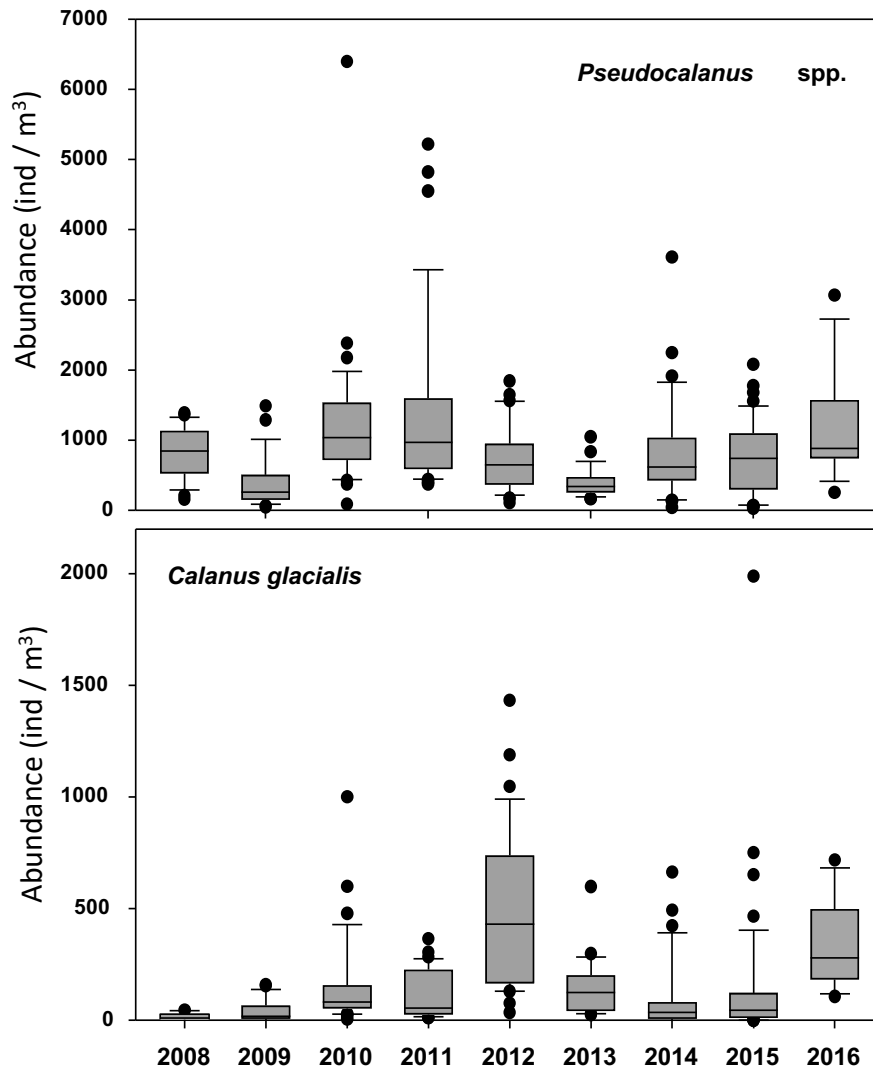


- **Interannual variability** in fish
- Higher species richness in 2017
- Higher biomass in some species (Arctic cod)
- Warmer temperatures?

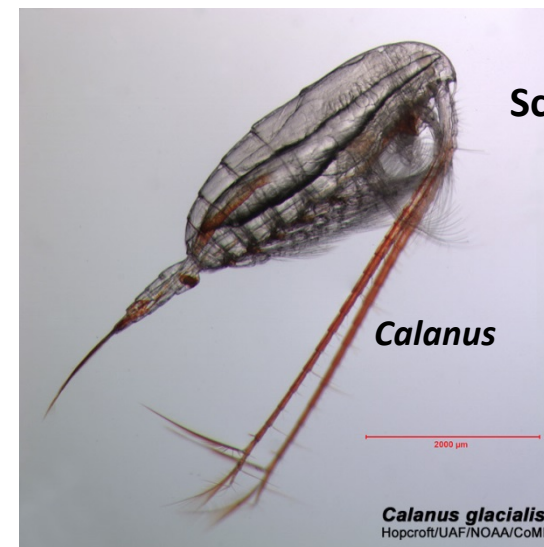


- **Interannual variability** in seabirds
- Fewer birds in 2017 than 2015
- Less shearwaters in north and less least auklets in central breeding colonies
- Poor food conditions? Low overwinter survival?





- Adding to **10-year time series** in northern Chukchi Sea
- Warm years tend to be dominated by smaller-bodied *Pseudocalanus* species
- Coldest years are dominated by larger-bodied *Calanus* species



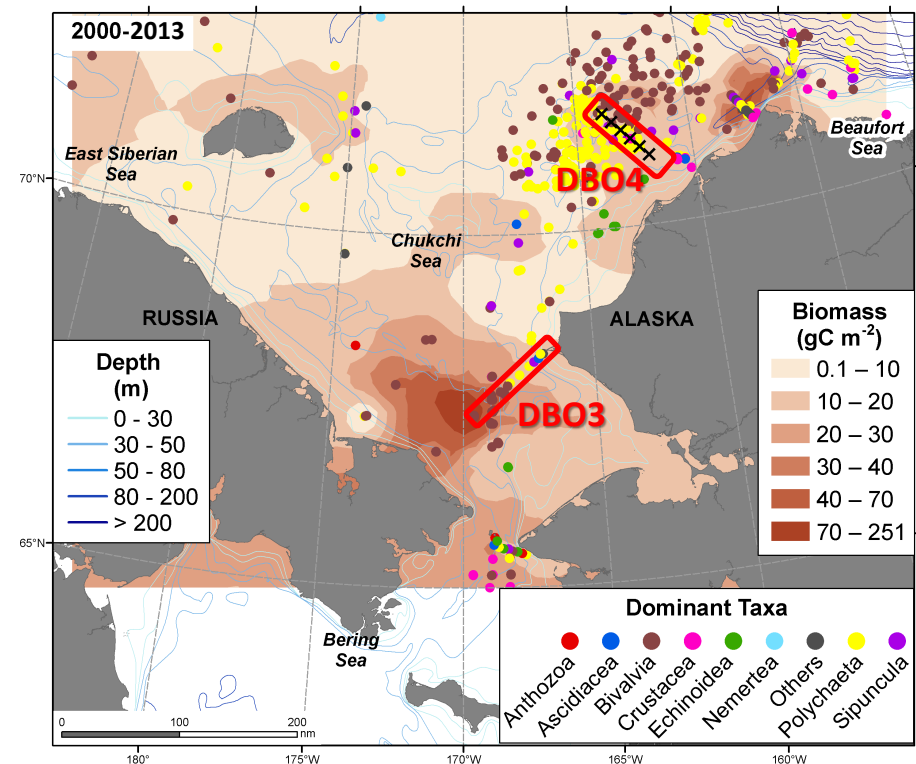
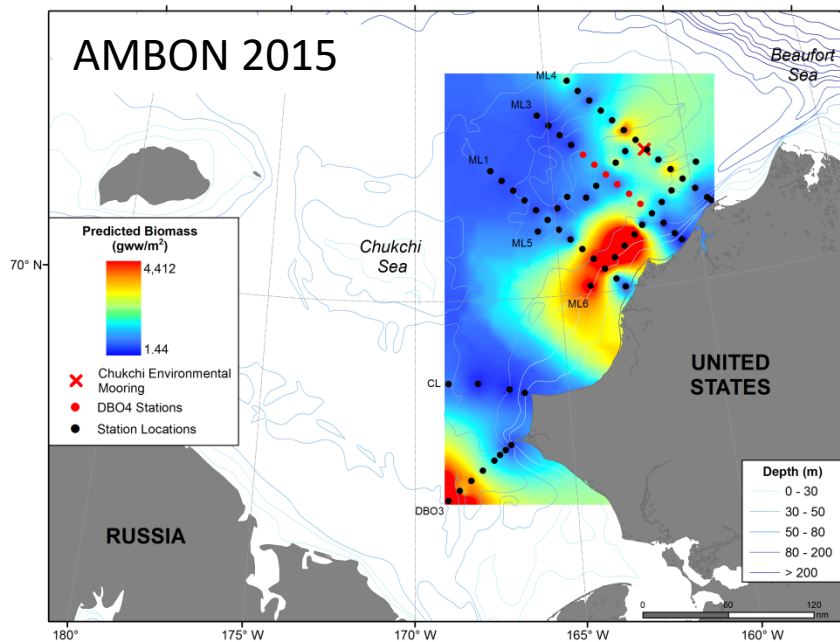
Scaled to relative size



*Pseudocalanus*



- Adding to **long-term time series**, persistence of macrofauna “hotspots”
- Link to Distributed Biological Observatory – DBO



- All project metadata represented on MBON data portal
- Use Darwin Code for biological data sets to link to NCEI
- AMBON data discoverable through the IOOS MBON data portal

**IOOS Marine Biodiversity Observation Network**

**Result types**

- Data Layers
- Projects
- Sensor Stations

**Advanced search options**

- AMBON Projects (14)
- Alaska (18)
- Bathymetry (1)
- Benthic Communities (7)
- Biodiversity (9)
- Biodiversity Indices (5)
- Birds (8)
- California (15)
- Environmental (4)
- Fish (12)
- Florida (48)
- Ground Temperature (1)

**Arctic Marine Biodiversity Observing Network (AMBON)**

Arctic Marine Biodiversity Observing Network (AMBON)

Layers Downloads

**AMBON - Chlorophyll-A and Nutrient**

This data is part of the Arctic Marine Biodiversity Observing Network (AMBON). The dataset is a comma separate values file that can be downloaded as a Microsoft Excel spreadsheet. This dataset includes measurements of water samples collected at hydrographic stations during during a research cruise during August-September 2015 in the Chukchi Sea, U.S. Arctic. Data includes by column: Station Number, Station Name, Date (GMT), Latitude, Longitude, Depth (m) ...

**AMBON - Benthic Epifauna**

2015 / Final\_data\_2015\_DwC | Metadata

- AMBON2015\_epifauna\_biomass\_DwC.csv (551.6 kB) File Metadata
- AMBON2015\_epifauna\_abundance\_DwC.csv (498.9 kB) File Metadata

1 *In Review at Deep-Sea Research ii (DBO Special Issue)*

2 **Does one size fit all? Observational design for epibenthos and fish assemblages in the Chukchi Sea**

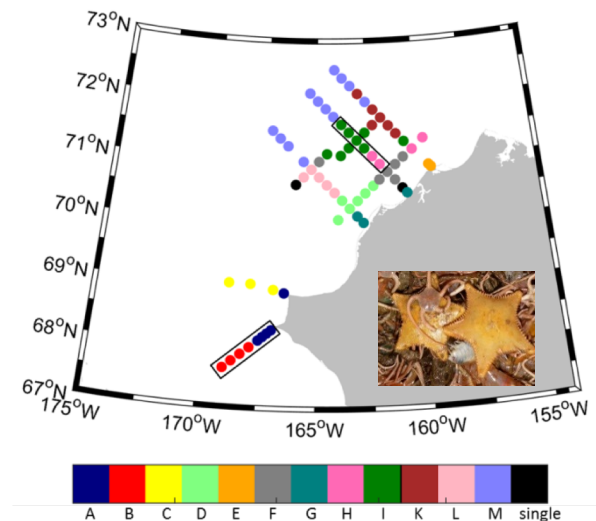
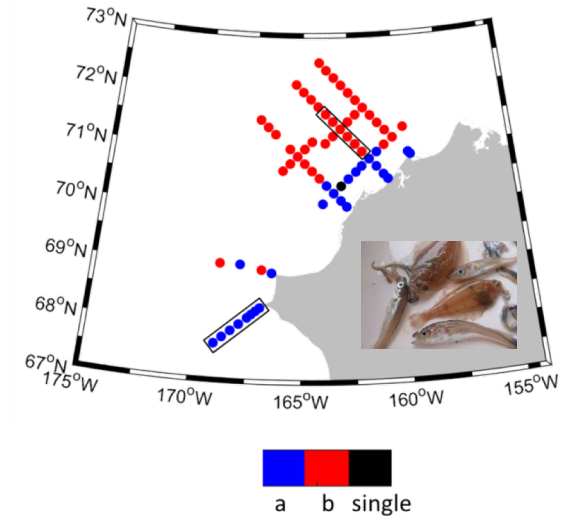
3 Iken K<sup>1,\*</sup>, Mueter F<sup>1</sup>, Grebmeier JM<sup>2</sup>, Cooper LW<sup>2</sup>, Danielson S<sup>1</sup>, Bluhm B<sup>3</sup>

4 \* Corresponding author: [kbiken@alaska.edu](mailto:kbiken@alaska.edu), phone: 907-474 5192

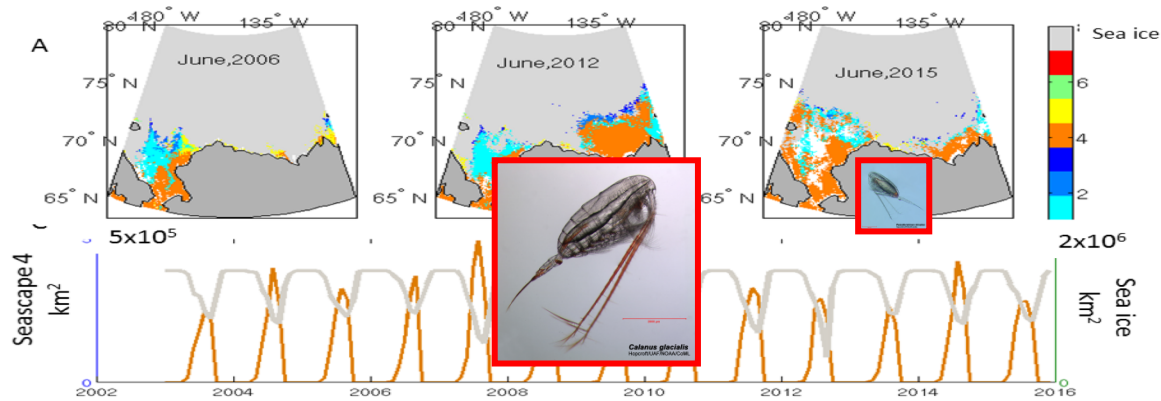
### 6 **Abstract**

7 In light of ongoing, and accelerating, environmental changes in the Pacific Arctic Ocean, the ability to  
8 track subsequent changes over time in various marine ecosystem components has become a major  
9 research goal. The high logistical efforts and costs associated with arctic work demand the prudent use  
10 of existing resources for the most comprehensive information gain. Here, we compare the information  
11 that can be gained for epibenthic invertebrate and for demersal fish assemblages from two existing  
12 long-term observational programs in the Chukchi Sea: two transects of the Distributed Biological  
13 Observatory (DBO) and the Arctic Marine Biodiversity Observing Network (AMBON). The two DBO lines

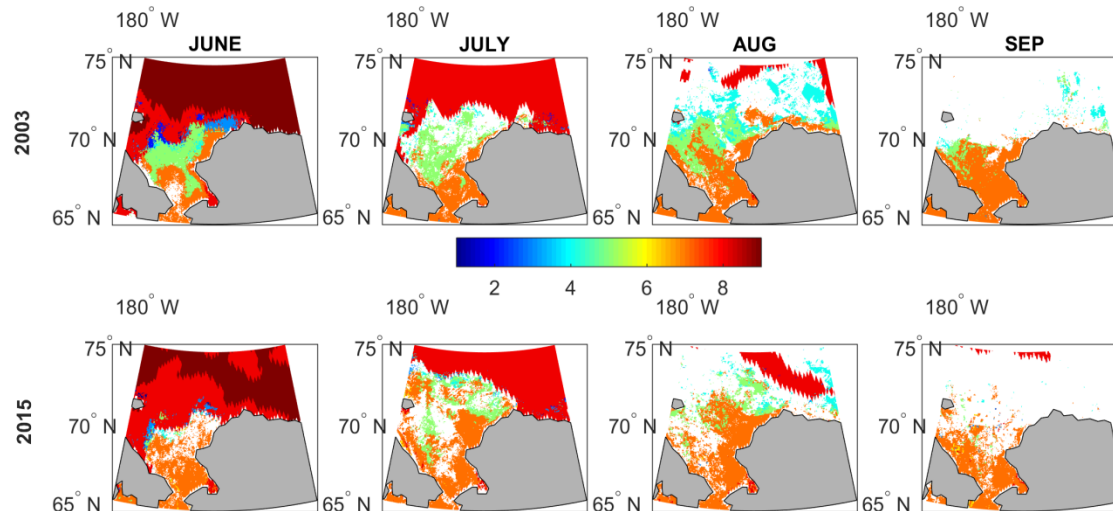
- Manuscript in review using AMBON data to assess spatial observational design for epifauna and fish (AMBON vs DBO)
- Recommendations made for extension of DBO 4 line for fish and epifauna sampling
- Example of management application by linking DBO and AMBON



- M. Kavanaugh's NSPIRES (NASA) project now linked to AMBON
- Kick-off networking during AMBON PI meeting (Jan 2018)



- How do dynamic seascapes characterize pelagic habitat across the array of conditions experienced in the Arctic?
- How are pelagic habitats and species associations changing in time?
- Zooplankton long-term data set ideal to test seascapes





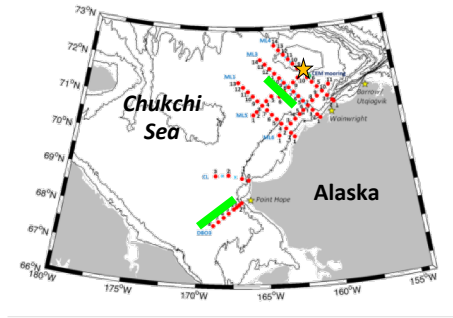


Past year

Impact

X-MBON

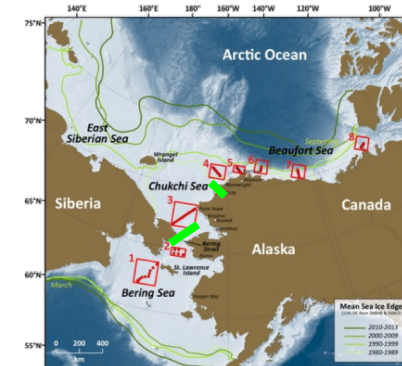
## AMBON



Biodiversity focus  
Large regional coverage  
Microbes to whales

## DBO

### Distributed Biological Observatory

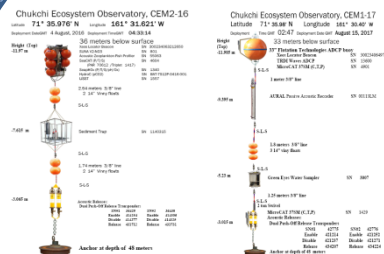


Regional biomass "hotspot" transects  
Change detection array

**AOOS**  
Alaska Ocean Observing System

## CEO

### Chukchi Ecosystem Observatory



Year-round high resolution  
ecosystem monitoring &  
process studies

Seasonality

Complementary

Data

Temporal scale

Spatial scale

Seascapes

Logistics

Biomass

Biodiversity

Open access

## Informing management entities



*Interagency Arctic Research Policy Committee*

- Arctic Research Plan for 2017-2021
- Goals: *Well-being, Stewardship, Security, Arctic-Global Systems*
- Performance elements:
  - ***4.1. Increase knowledge on the distribution and abundance of Arctic marine species across all trophic levels and scales***
    - *4.1.2. Continue studies to document Arctic marine species biodiversity (e.g. Arctic Marine Biodiversity Observation Network—AMBON—and programs that monitor loss of sea ice) and habitat use in the Arctic. Ensure datasets will be available through open access data portals.....*
  - ***4.3 Advance the understanding of how climate-related changes, biophysical interactions, and feedbacks at different scales in the marine ecosystems impact Arctic marine resources and human communities***
    - *4.3.1 Continue Distributed Biological Observatory (DBO) sampling in regions 1-5 and make data publicly available .....*



- Discussions about using AMBON template for observing network in other Arctic regions under gas & oil development (Environmental Studies Planning)

				
<b>OOGURUK ISLAND</b> Operated by: Caelus Constructed in 2007 Island Surface: 6 acres Water Depth: 4.5 feet Subsea Pipeline: 5.7 miles	<b>NIKAICHUQ ISLAND</b> Operated by: ENI Petroleum Constructed in 2011 Island Surface: 11 acres Water Depth: 8 feet Subsea Pipeline: 3.8 miles	<b>NORTHSTAR ISLAND</b> Operated by: Hilcorp Constructed in 2000 Island Surface: 7 acres Water Depth: 40 feet Subsea Pipeline: 6 miles	<b>ENDICOTT</b> Operated by: Hilcorp Constructed in 1987 Island Surface: 45 acres Water Depth: ~4 feet Subsea Pipeline: none	<b>LIBERTY ISLAND</b> Operated by: Hilcorp Construction: tbd - 2019 Island Surface: 9.3 acres Water Depth: 19 feet Subsea Pipeline: 5.6 miles



ARCTIC COUNCIL

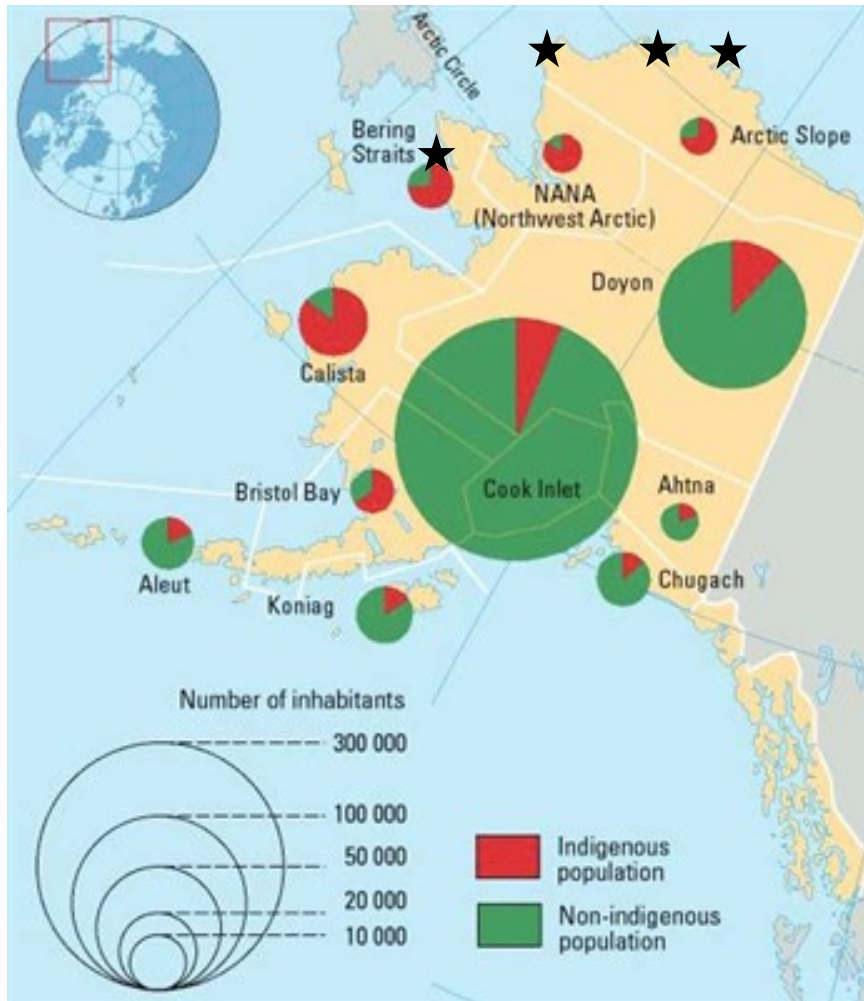


Conservation of Arctic Flora and Fauna

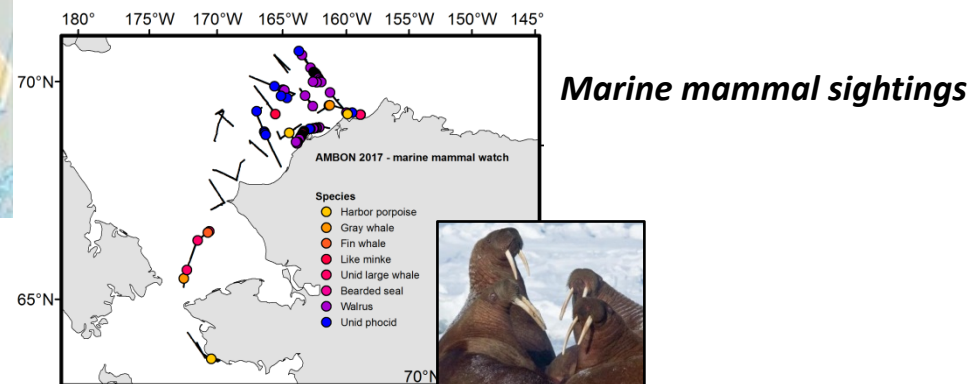
- Circumpolar Biodiversity Monitoring Program (CBMP)
  - AMBON PIs as expert members in CBMP
  - State of the Arctic Marine Biodiversity Report (SAMBR, 2017)







- Real-time sharing with **stakeholders**
- Daily e-mail to Native villages and managers (85 recipients)
- Presenting in Nome (Bering Strait region) before cruise
- Presenting to Alaska Eskimo Whaling Commission (AEWC)
- Presenting to Alaska Waterways Safety Committee (AWSC)

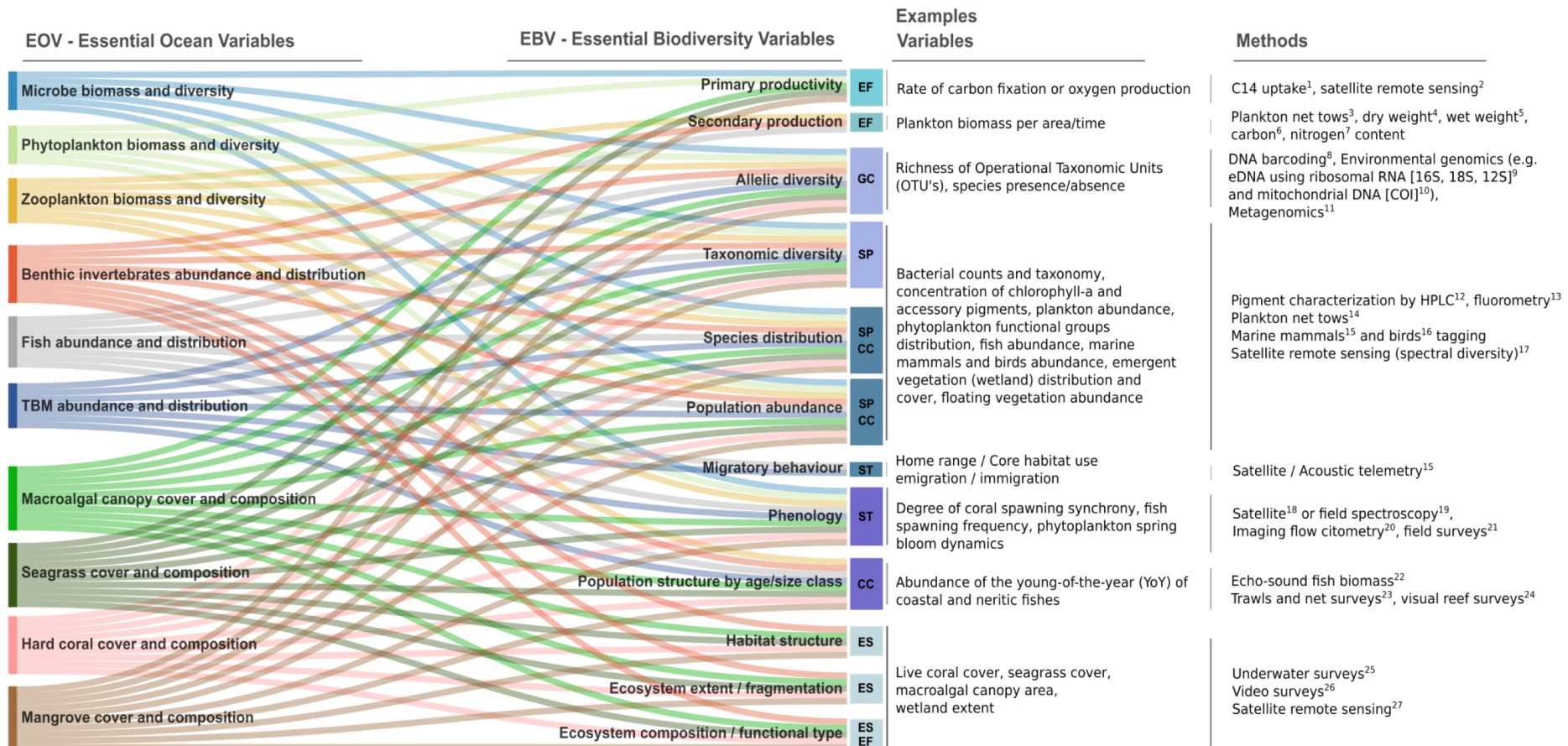


**How are we progressing with shared cross-MBON priorities, advancing eDNA methods for the MBON community, and leveraging seascapes?**





- Contribute to global efforts as feasible



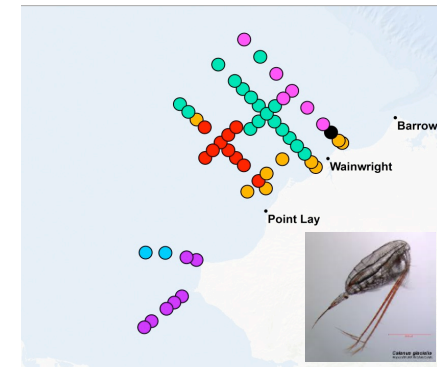
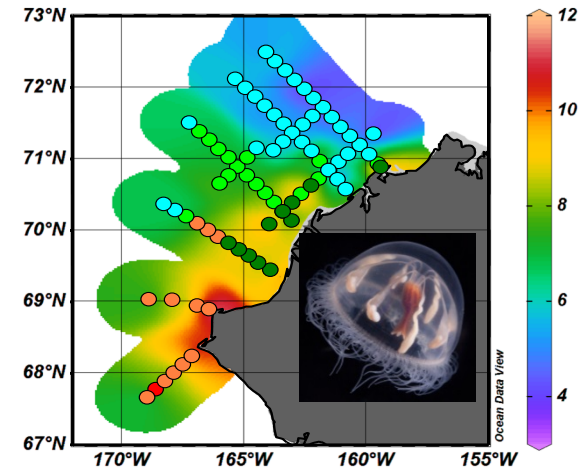
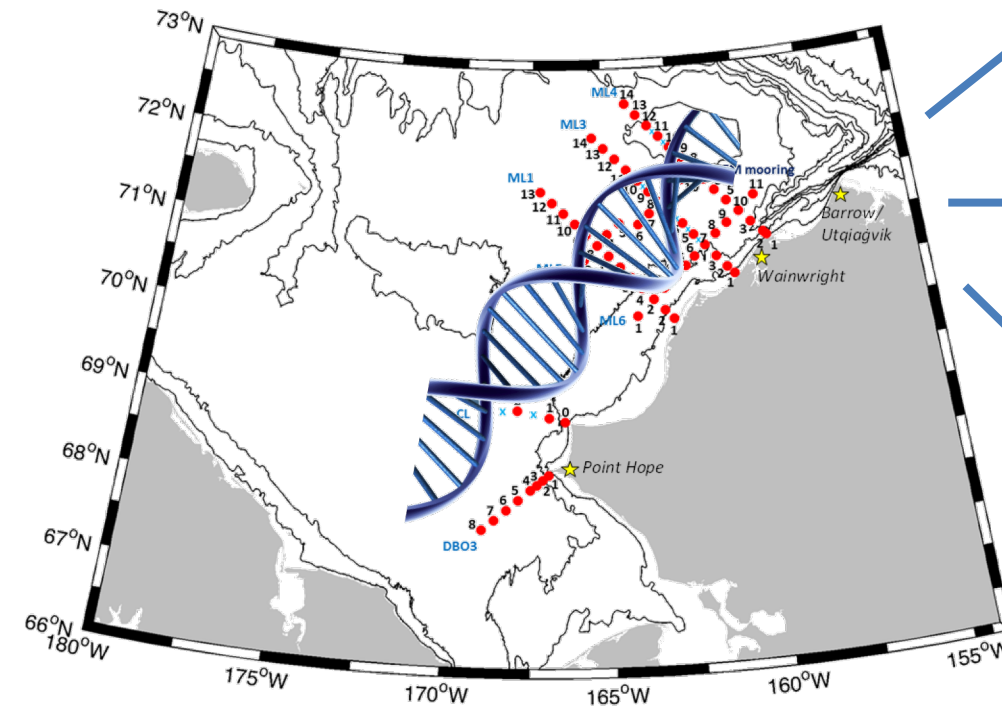
Past year

Impact

x-MBON

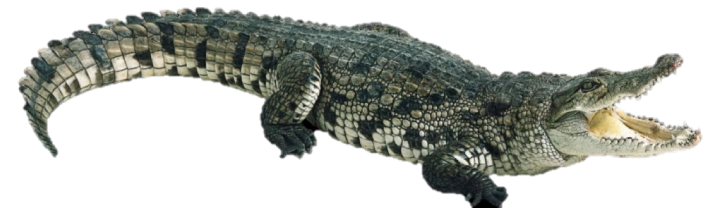
## eDNA

- Parallel effort (for consistency with historical data)
- Bacteria (16S), eukaryote (18S) and eukaryote (ITS)



?

?

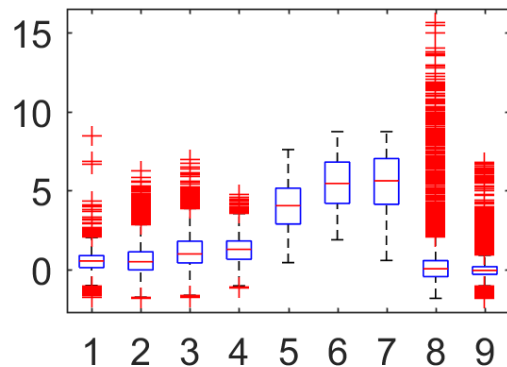


## Seascapes in the Arctic

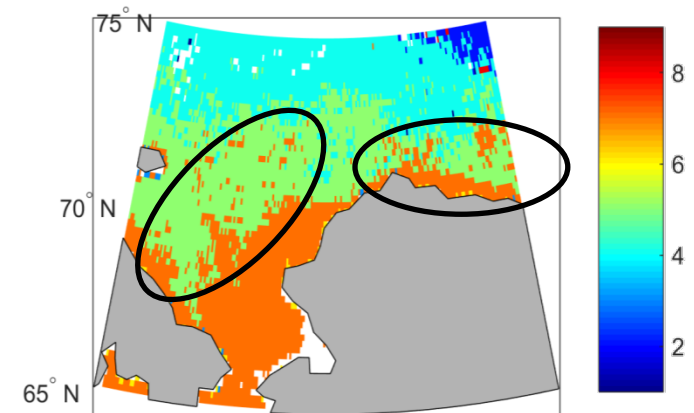
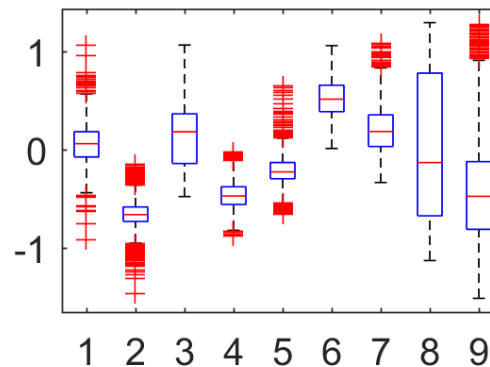
- Extend biogeographic framework across all US- MBONS
- Test classification
- Link to AMBON data (e.g., zooplankton)

### Seascape N= 9

sst

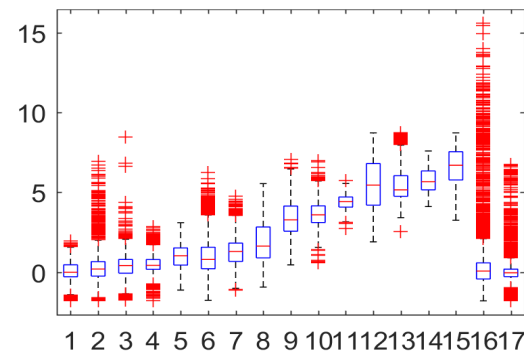


chl

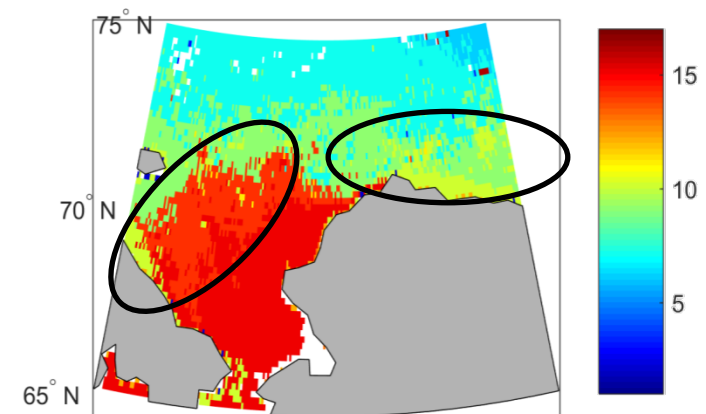
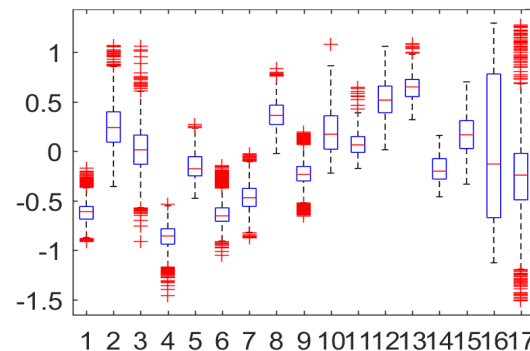


### Seascape N= 17

sst

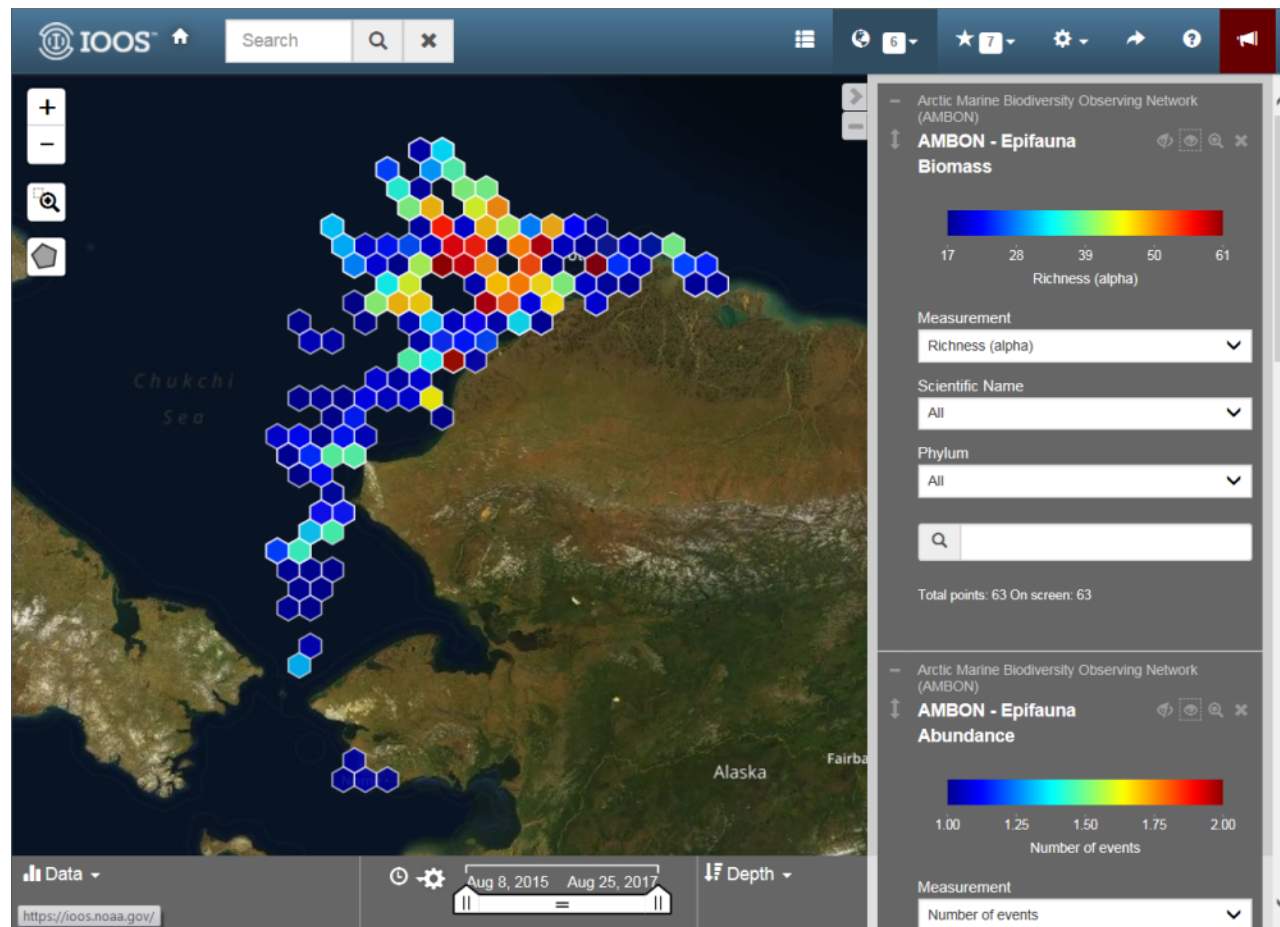


chl





- Test case for MBON data sets to OBIS
- AMBON data (2015, partial 2017) in MBON portal and discoverable
- <https://mbon.ioos.us/> (quick demonstration by Brian Stone, Axiom Data Science)





A wide-angle photograph of a sunset over a body of water. The sun is a large, bright, glowing orb in the upper left quadrant, casting a long, shimmering reflection across the water's surface. The sky is a gradient of warm colors, from deep orange near the horizon to a pale yellow at the top. The water is dark, with numerous small, white ice floes scattered across it. In the lower right, there is a larger, more prominent ice formation. The overall mood is serene and peaceful.

**Thank you!**